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# Testing the effectiveness of escapement mechanisms in derelict crab pots

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# Crab Trap Escapement Study

## Determining the Effectiveness of Dungeness crab (*Cancer magister*) Escapement in Derelict Traps Commonly used in the Washington Waters of the Salish Sea

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## Introduction

**An estimated 179,000 Dungeness crab are killed in derelict traps each year in Washington waters of the Salish Sea**. This is assuming all traps that are legally compliant with escape cord regulations were disabled at the point of escape cord degradation. However, 21% of all "disabled" traps removed during derelict trap recovery projects still contained live and/or dead Dungeness crab. Reasons include: biofouling, improper rigging of gear, and trap design. The resulting impacts can reach an additional 12,000 to 30,000 Dungeness crab killed in derelict traps per year.

*Escape cord is biodegradable twine, usually made of cotton. In the event that a trap becomes derelict, an egress route held closed by escape cord becomes available upon escape cord degradation, disabling the trap.*

This study was designed to identify which of the commonly used trap styles in the region are most (and least) effective in allowing crab to escape after the trap has become disabled. The research was undertaken to inform fishers, resource managers, and manufacturers of trap styles and modifications that are most effective, as part of the overall goal to reduce Dungeness crab mortality due to lost traps.

## Study Design & Methods

This research was conducted at the NOAA Mukilteo Research Station in Mukilteo, Washington, in tanks equipped with continuously aerated and circulating sea-water pumped in from nearby waters.


- Crab captured, tagged, measured – data recorded
- 13 trap styles tested, including 2 modifications
- 90 individual crab tested per trap style
- Phase 1: 3 rounds, 30 traps tested each round
- Phase 2: 2 rounds, 15 traps and 12 traps tested
- 10 crab tested in each individual trap per round

The same population of crab were used throughout the study; each crab was tested in a different style trap during each round to eliminate learned behavior.

Place 10 crab in un-baited traps; set in tanks

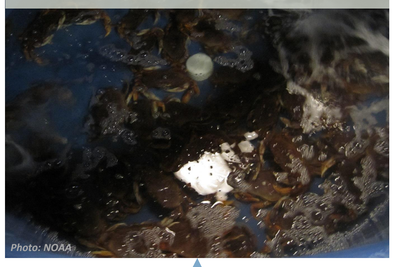

7 day holding period simulating derelict trap


Place crab bait in tank, outside trap to entice escapement

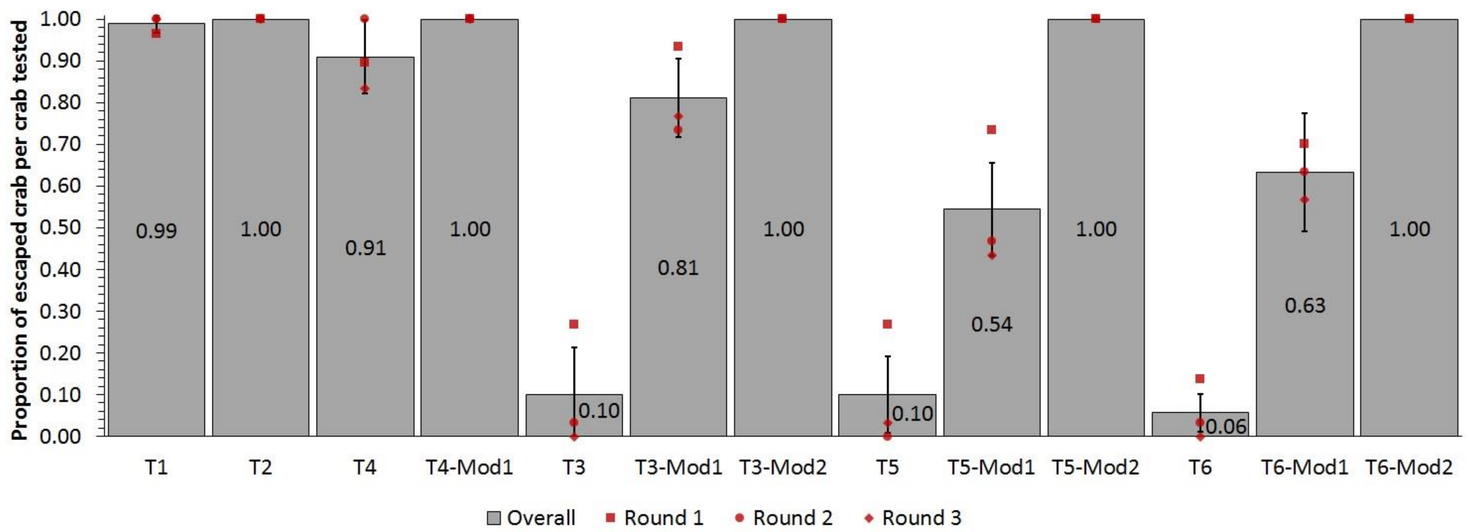

Disable trap; cut escape cord


Remove escaped crab and record escapement for up to 14 days


Crab held and fed for 7 days, then repeat

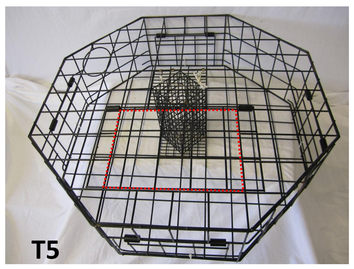



## Results

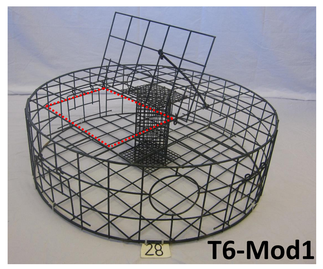



*Estimated legal-sized Dungeness crab escapement rates by trap design, overall and per round, in simulated derelict recreational traps commonly used in Washington waters of the Salish Sea (Error bars shown in 95% confidence intervals*.

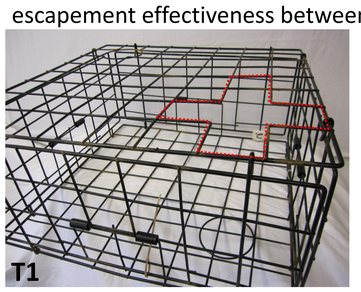
Significant differences in Dungeness crab escapement were found between trap styles. The most effective unmodified traps had an escape rate of 1.00 escaped crab per crab tested, with the least effective escapement rate being 0.06 escaped crab per crab tested. Simple modifications tested during the study enabled trap styles with poor escapement rates to achieve the desired rate of 1.00 escaped crab per crab tested.



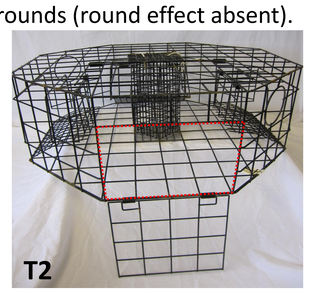

**Least Effective (T3, T5, T6)**: The least successful trap designs in allowing crab escapement were those with escape routes that require crab to push open a door situated on the topside of the trap, offset from the edge. Effectiveness increased with Modification #1 (spring-loaded door), but remained imperfect (0.54 – 0.81). These traps showed a significant difference in escapement effectiveness between rounds (round effect present), with much greater success in round 1 than in rounds 2 and 3.



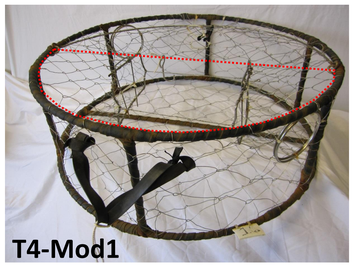

**Most Effective**: The traps most successful at allowing crab escapement were those that provided an unobstructed escape panel either on the wall of the trap or along the edge of the topside of the trap. This included all those tested with Modification #2. No significant differences in escapement effectiveness between rounds (round effect absent).



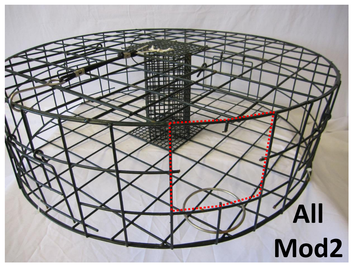

81% of total escapement within 3 days




100% escapement within 4 days




97% of total escapement within 3 days




100% escapement within 2 days

## Conclusions

- The traps most effective at allowing crab escapement provided an unobstructed escape panel either on the wall of the trap or along the edge of the topside of the trap.
- The least effective trap designs were those with escape routes that require crab to push open a door situated on the topside of the trap, offset from the edge.
- Obstructed escape routes, even with doors sprung open, are less effective when offset from the edge of the trap.
- The round effect present in some escapement designs, but not others, suggests that healthy and unhealthy crab escape from traps with unobstructed escape routes, while some healthy and fewer unhealthy crab escape from traps with obstructed escape routes.
- Traps with poorly designed escape mechanisms can become extremely effective with the simple modification of detaching the escape ring and re-attaching it in the same place with escape cord.

## Acknowledgements

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